

Chapter 5:

FUTURE CONDITIONS:

LOOMIS STATE FOREST

&

LITTLE PEND OREILLE BLOCK

In this chapter, the long term feasibility of LAU-level Lynx management guidelines is tested using modeled habitat predictions. The first section provides an overview of the modeling approach and parameters used within each study area. Next, assumptions are identified. After initial stand conditions are identified, lynx habitat predictions are given. Forage production assumptions are tested in the concluding section.

5.1 Overview of the Modeling Approach

5.2 Assumptions

5.3 Initial Stand Conditions

5.4 Lynx Habitat Predictions for the Planning Period

5.5 Test of Forage Production Assumptions

5.1 Overview of the Modeling Approach

The long-term feasibility of the LAU-level lynx habitat management guidelines presented in Chapter 3 were tested with habitat projections for the three LAU's within the Loomis State Forest (Okanogan LMZ) and the Little Pend Oreille Block (Little Pend Oreille LMZ). The three tools employed to model habitat changes over the duration of the DNR Lynx Habitat Management Plan included: 1) Arc/Info v. 7.0, 2) the North Idaho version of the Forest Vegetation Simulator [FVS, formerly known as PROGNOSIS], and 3) the Scheduling and Network Analysis Program [SNAP] v. 3.14 and 3.17.

The SNAP analyses presented in this plan should not be considered harvest plans. Harvest levels and treatments predicted by the models represent the Department's most aggressive alternatives within the LAU's of concern. It is not likely that the Department will achieve this level of activity due to the many constraints encountered when developing and implementing actual harvest plans. However, SNAP made it possible to examine the potential occurrence of lynx habitat categories over the duration of the plan with full plan implementation. These predictions also provide the Department with confidence that the habitat management guidelines are operationally feasible. The development of actual harvest plans for the LAU's will require actual logging settings and completely designed road systems, and will incorporate updated lynx habitat data gathered during monitoring (Chapter 6). The Department has confidence that the harvest plan will result in more favorable lynx habitat conditions.

Many analyses were conducted to test our assumptions and the interaction of forest management constraints on lynx habitat over time. However, the set of general modeling requirements and constraints remained constant among analyses. Constraints based on the lynx habitat guidelines included height-based area limitations over LAU's, maximum allowable even-aged harvest unit sizes, and adjacency requirements for placement of even-aged harvest units within LAU. Constraints based on DNR forest management policies included even-flow harvest volume requirements and age-based area limitations on WAU's. Details of constraints based on planned DNR forest management within the Loomis State Forest can be found in the Loomis Landscape Plan (DNR 1996). Other modeling parameters are described below.

5.1.1 Modeling Parameters used within the Loomis State Forest

Analyses within the Loomis State Forest were run through the 80 year duration of the planning period using 16 five-year intervals. Initial management assumptions and harvest targets were adopted from the Loomis Landscape Plan (DNR 1996).

Stands initially targeted for harvest in the first decade were selected based on status of insect infestation. Maximum total area in younger age classes was initially set by WAU and LAU, based on hydrologic maturity thresholds. Later runs did not include the maximum total area in younger age classes criteria when it became obvious that other constraints were more restrictive and kept age classes below the threshold without these seral stage constraints. A maximum area for stands less than nine years of age or less than seven feet in height was set at 200 contiguous acres.

The model was constrained by minimum and maximum harvest unit sizes as defined in the Loomis Landscape Plan (DNR 1996). Under the Loomis Plan, individual harvest units will generally not exceed 100 acres. The maximum sustainable harvest volume for the combined LAU's was found by doing analysis iterations with higher and lower harvest ratios.

5.1.2 Modeling Parameters used within the Little Pend Oreille Block

Analyses within the Little Pend Oreille Block were run through the 80 year duration of the planning period using eight 10 year intervals. Harvest levels and management regimes were based on consultation with DNR Northeast Region staff.

The model was constrained by the minimum and maximum harvest unit sizes defined in the Loomis Landscape Plan (DNR 1996). A maximum area of stands less than nine years of age or less than seven feet in height was set at 200 contiguous acres. The maximum sustainable harvest volume for the combined LAU's was found by doing analysis iterations with higher and lower harvest targets.

5.2 Assumptions

The modeling process in both areas consisted of three steps: 1) stratifying the landscape by vegetation zone to ensure similar growth rates and treatment responses, 2) matching a silviculture regime or set of regimes to each vegetation zone, and 3) simulating the effects of silviculture treatments over time to determine the ratio of lynx habitat categories on the landscape at periodic intervals.

5.2.1 Stratifying the Landscape By Vegetation Zone

The landscape was stratified by vegetation zones as an attempt to delineate functional ecological units. The climatic, geologic, and biotic differences that result in distinct vegetation zones also

reflect functional differences that influence the way in which management goals can be achieved. Vegetation zones provide a common base from which to map and express resource condition and management requirements.

Seven Loomis vegetation zones were identified by extrapolating from plant association-specific stratified forest inventory data that was completed on the Loomis State Forest in 1993 (Table 20). The Douglas fir and Subalpine Fir zones are the most widespread within the Forest. Independent confirmation of the classification was conducted with Landsat information and field inspection. Details of the vegetation stratification are reported in the Loomis Landscape Plan (DNR 1996).

Table 20: Distribution of vegetation zones in the three Loomis LAU's.

Zone	Description	North LAU	Central LAU	South LAU
1&2	subalpine fir	11%	16%	20%
3	subalpine fir/lodgepole pine	38%	25%	20%
4	Douglas fir	22%	30%	31%
5	ponderosa pine	3%	8%	10%
6&7	non-forest or other non-harvested forest types	26%	21%	19%

The inventory available for the Little Pend Oreille Block could not provide a reliable plant association-specific vegetation zone classification. However, existing forest inventory, Landsat data, and field inspection of the area were used to divide the LAU into two distinct vegetation zones that reflect different growth rates and management (Table 21). Forest inventory scheduled for the area 1997 will facilitate reclassification of the LAU into plant association-specific zones similar to those developed for the Loomis State Forest.

Table 21: Distribution of vegetation zones in the Little Pend Oreille Block.

Zone	Description	Occurrence within the Little Pend Oreille Block
1	Grand fir and Western hemlock	82%
2	Ponderosa pine	18%

5.2.2 Matching Silviculture Regimes to Vegetation Zones

For simulation purposes, silviculture regimes were designed for each vegetation zone on the Loomis State forest by area foresters. The regimes were tested and refined to ensure that they would result in the anticipated growth rates, wood production, and habitat characteristics. The growth of stands under plant association-specific silviculture regimes were modeled from bare ground through the entire rotation using the North Idaho variant of FVS, and by projecting current stands forward in time. See the Loomis Landscape Plan (DNR 1996) for details of the management regimes and Appendix C for their general application by LAU.

Management regimes were developed for simulation purposes on the Little Pend Oreille Block were developed in consultation with region foresters (Table 22). The regimes reflect the anticipated ratios of each treatment type based on past experience (Appendix C).

Table 22: Little Pend Oreille Block management regimes by vegetation zone.

Zone	Description	Management regime
1	grand fir and western hemlock	60% of the area will be managed using even-aged techniques, with a rotation age of approximately 70 years (depending on the site characteristics) 40% of the area will be managed using uneven-aged techniques, removing 40% of the timber volume no more frequently than every 30 years
2	ponderosa pine	100% uneven-aged management, removing 40% of the timber volume no more frequently than every 30 years

5.2.3 Simulating the Effects of Silviculture Treatments: Lynx Habitat Through Time

SNAP analysis was used to estimate the occurrence of lynx habitat categories over time on both the Little Pend Oreille Block and the Loomis State Forest. SNAP does not predict the specific stand characteristics that would ideally be used to derive the habitat status of a stand. In modeling habitat status, it was assumed that age criteria could be used as a surrogate for stand characteristics (Table 23). The following criteria defined each lynx habitat type:

Temporary Non-lynx Areas: stands in which dominant and co-dominant trees have a minimum height of less than or equal to seven feet. The time required to create lynx forage is a product of two values: 1) a regeneration lag assuming the time necessary for a sufficient number of naturally regenerated seedlings to establish, and 2) a required growth period for the trees to reach sufficient height. This period is summed to produce the regeneration lag required to create forage habitat.

Forage Habitat: stands in which dominant and co-dominant trees have a minimum height of seven feet. These conservative estimates do not assume a second flush of Forage after intermediate treatments nor do they consider contributions that older stands may make to Forage Habitat.

Travel Habitat: forested areas with a minimum of 180 trees per acre, where the dominant and co-dominant trees have a minimum height of seven feet, that have not been included as other habitats

Potential Denning Habitat: stands of at least 90 years on the Loomis LAU's and of greater than 70 years in the Little Pend Oreille Block.

Table 23: Age criteria used in SNAP modeling of lynx habitat through time.

LAU	Zone	Regeneration Lag to Create Forage Habitat	Duration of Forge Habitat
Loomis	Zone 1 and 2 (subalpine fir)	10 years	15 years
Loomis	Zone 3 (subalpine fir/lodgepole pine)	15 years	20 years
Loomis	Zone 4 (Douglas fir)	30 years	20 years
LPO Block	grand fir and western hemlock	10 years	20 years
LPO Block	ponderosa pine	20 years	10 years

5.3 Initial Stand Conditions

There were no existing data sources specifically designed to determine the current lynx habitat status of DNR-managed lands. The initial habitat ratios were determined as described in section 4.1 and Table 13. Several lines of evidence suggest that the current conditions reported in Table 19 for the three Loomis State Forest LAU's represent highly conservative estimates of lynx habitat components. Monitoring associated with implementation of this plan will increase our ability to accurately predict future stand conditions.

The initial habitat component ratios reported in this plan are based on modified versions of the existing forest inventories to reflect local area forester interpretations of the habitat criteria and activities conducted since the last inventory. Any management activity in the past was assumed to result in Non lynx habitat that started its recovery period at the initiation of the simulation. Periods subsequent to period 1 are based solely on existing inventories and the habitat assumptions as defined in this plan. In reality, some of these stands will contribute forage. Given these initial stand conditions the Department is confident that updated lynx habitat conditions resulting from monitoring the Loomis LAU's (Chapter 6) will produce more favorable habitat ratios on each LAU.

5.4 Lynx Habitat Predictions for the Planning Period

5.4.1 Loomis State Forest

The Forested Habitat Ratio of 70% is met during all planning periods (Fig. 33, acres in Appendix C). Forage Habitat increases in the beginning of the planning period, declines, then reaches a smaller peak by decade seven. Although Forage Habitat levels do not often meet the Forage Habitat ratio of 20%, the actual levels of Forage Habitat available may be within the ratio due to the conservative approach taken to model forage duration and production. Monitoring activities (next chapter) will strengthen our understanding of this habitat component. Meanwhile, availability of Potential Denning Habitat (Travel Habitat > 90 years old) remains high throughout the planning period. There is a general trend toward more even proportions of lynx habitat components through the planning period.

North

The Forested Habitat ratio is maintained throughout the duration of the plan, with 75% or more Forested Habitat per period. Median acreage of Temporary Non-lynx Area is 13% of the total lynx habitat area for the modeled periods. Forage Habitat remains low overall (median = 14%). The number of periods with greater than 16% Forage Habitat is the highest of all Loomis LAU's

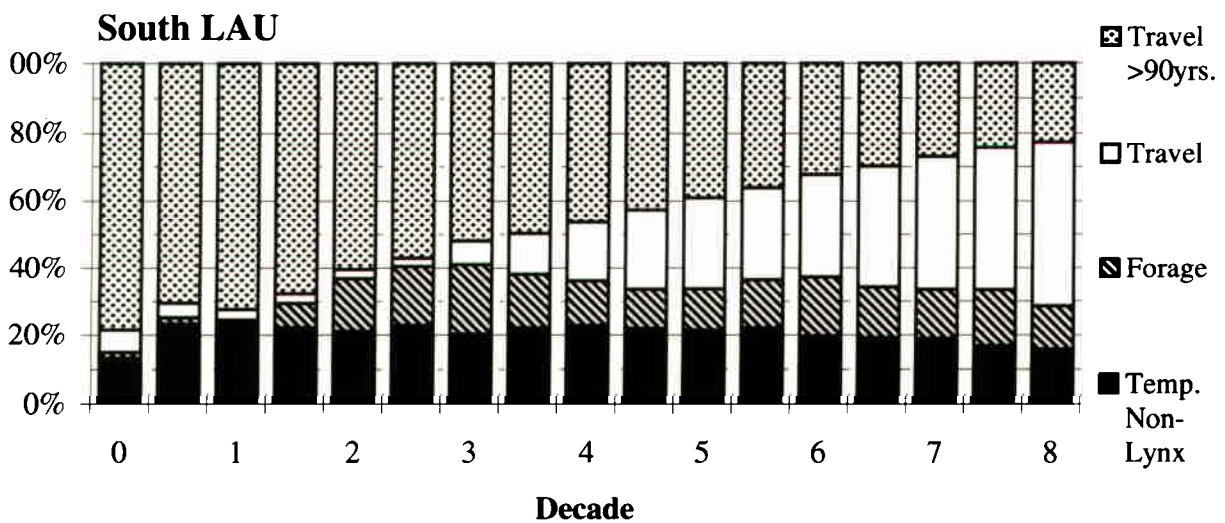
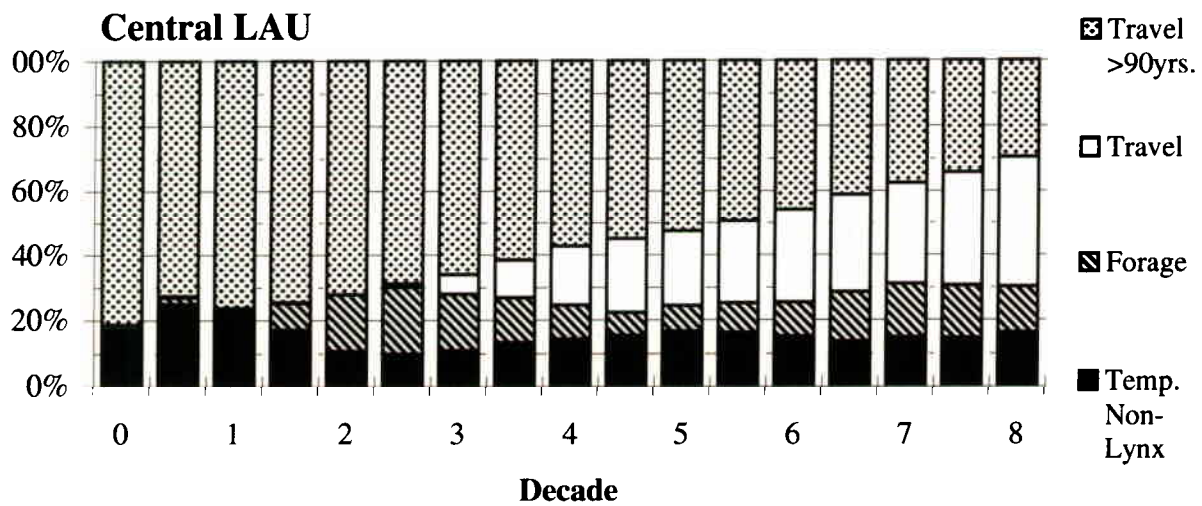
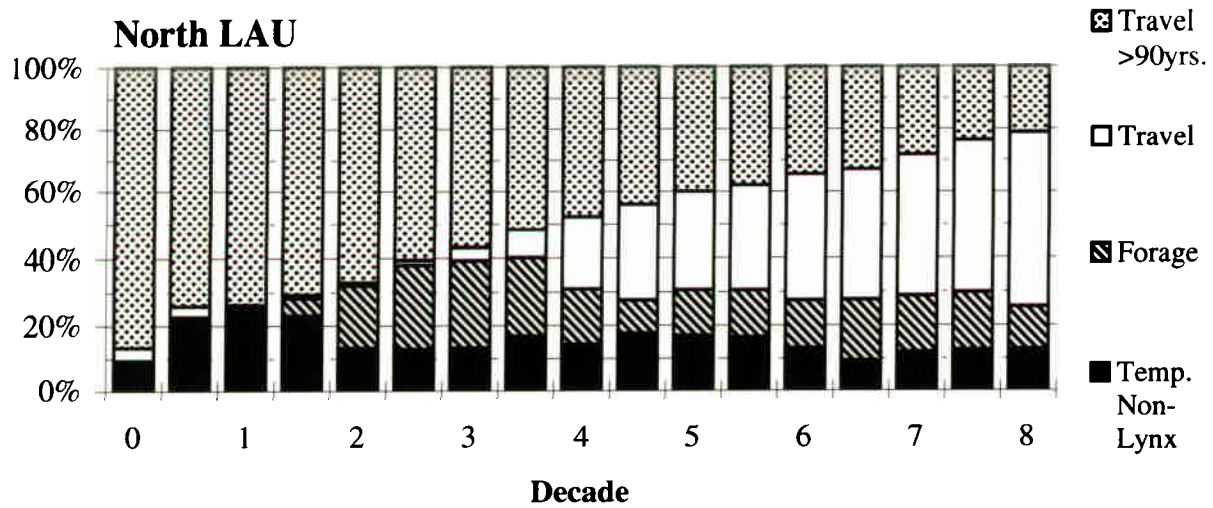


Figure 33: Projected lynx habitat components throughout the planning period on the Loomis State Forest, by five year period (see Appendix C for acreages).

(8/16 periods), providing the most prey habitat in the LAU where lynx have the highest potential to occur (4.3.1.3). Potential Denning Habitat (Travel > 90 years old) never falls below 21% of lynx habitat within the LAU, and thus the minimum 10% Denning Habitat ratio may be exceeded if field inspection reveals that these areas indeed meet Denning Habitat criteria. Decade four provides the most even distribution of lynx habitat types, with older forests dominating the forest spectrum at the beginning and end of the planning period.

Central

In the Central LAU, Forested Habitat remains above 75% in each period through the duration of the plan, with a median of 15% Temporary Non-lynx Area. Forage Habitat is the lowest of all Loomis LAU's (median = 10%), only exceeding 16% in four of the 16 planning periods. Potential Denning Habitat never falls below 29% per period, and thus the 10% minimum Denning Habitat ratio may be exceeded if field inspection reveals that these areas indeed meet Denning Habitat criteria. However, the distribution of lynx habitat becomes more even throughout the duration of the plan.

South

Forested Habitat is maintained at 75% or higher throughout the duration of the plan, with a median of 21% Temporary Non-lynx Area. The higher levels of Temporary Non-lynx Areas reflect the drier conditions and associated vegetation within this LAU (4.3.1.3). Median available Forage throughout the planning period is 14%, with only four of 16 periods providing >16% Forage Habitat. Potential Denning Habitat never falls below 22% in the duration of the plan, and thus the 10% Denning Habitat ratio may be exceeded if field inspection reveals that these areas indeed meet Denning Habitat criteria. Decades 4-7 provide the most evenly distributed proportions of lynx habitat types.

5.4.2 Little Pend Oreille Block

at least 80% of Little Pend Oreille Block will be in Forested lynx habitat status throughout the eight decade planning period, meeting the Forested Habitat ratio for LAU's (Fig. 34). Temporary Non-lynx Areas will result from a combination of partial cuts (5-16% of the LAU per decade) and seed tree cuts (4-11% of the LAU per decade). Consequently, Forage Habitat increases in availability from 3% in the first decade to 28% in the sixth decade, meeting the Forage Habitat ratio during the last four decades. Denning habitat was not separated from Travel Habitat in this analysis.

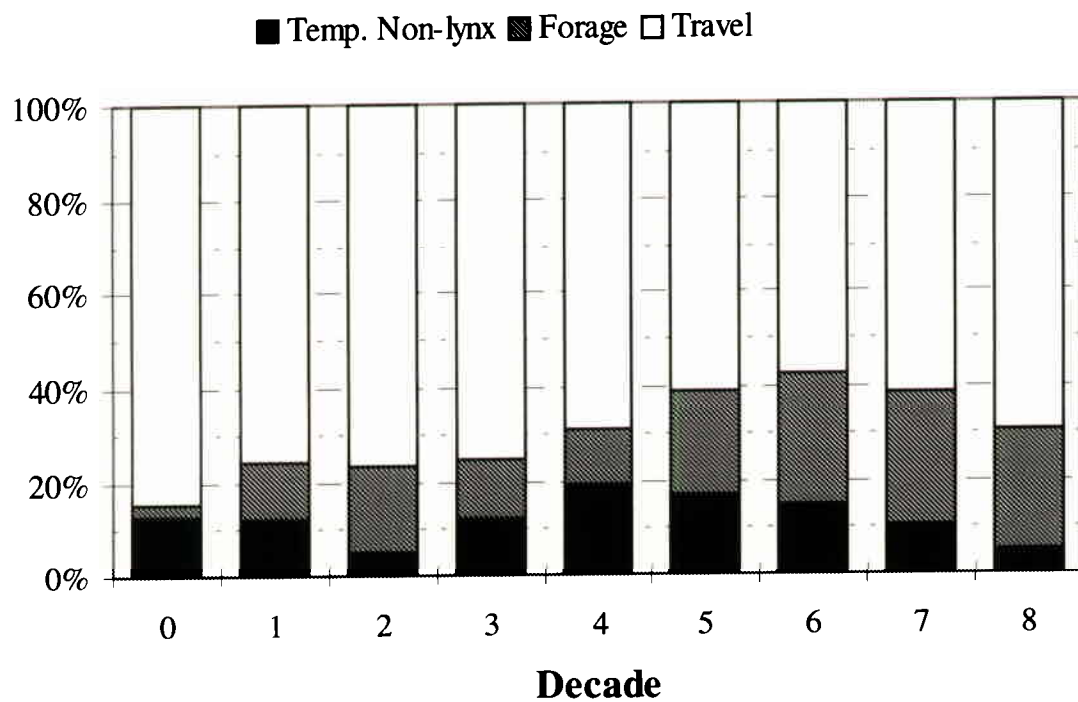


Figure 34: Projected lynx habitat components on the Little Pend Oreille Block throughout the planning period, by decade (see Appendix C for acreages).

5.5 Test of Forage Production Assumptions

The time required to establish stands that meet the minimum forage habitat was determined through interviews with DNR foresters, field inspection of sites, specific regeneration surveys of potential forage on the Loomis State Forest, and independent prediction from the FVS model. To test the sensitivity of our lynx habitat predictions to our assumptions about the time required to produce forage habitat, the consequences of longer and/or shorter regeneration lags were examined (Fig. 35).

In the long term, regeneration lag assumptions have little effect on expected proportions of Temporary Non-lynx Area. Specifically, the regeneration lag assumptions resulted in $\pm 3\%$ change in the Temporary Non-lynx Area of a LAU. It is anticipated that all the LAU's will be well below the 30% maximum threshold. In the short term, only under the scenario of longest regeneration lag did the Temporary Non-lynx Area approach the 30% threshold. No other LAU's exceed the 30% threshold of Temporary Non-lynx Area. The initial focus of monitoring will be to field verify the assumed habitat conditions of the Loomis LAU's and confirm the stand development assumptions.

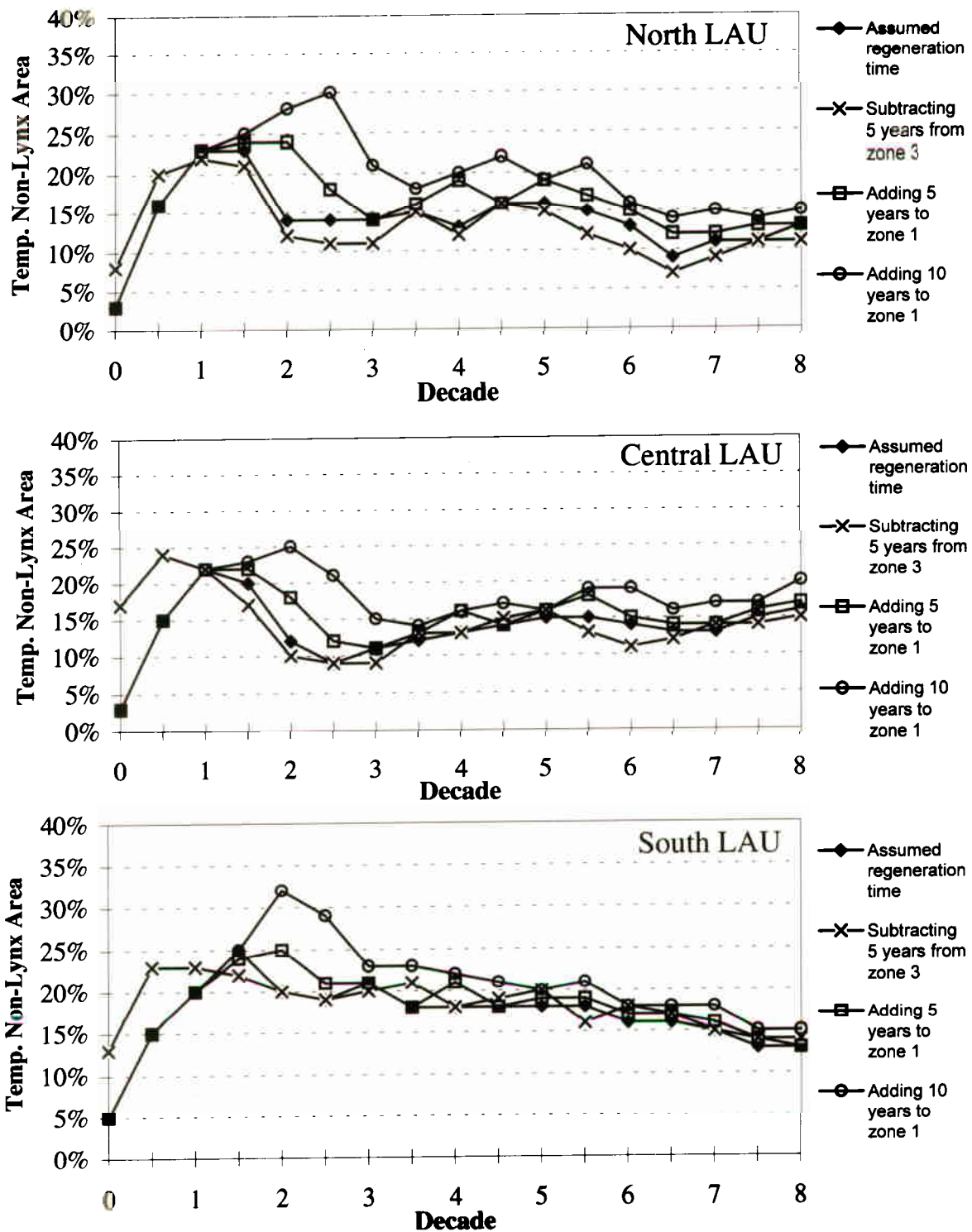


Figure 35: Sensitivity analysis of regeneration lags by LAU in the Loomis State Forest, showing the percent of Temporary Non-lynx Areas modeled to result if the original regeneration assumptions are changed according to the legend (see Appendix C for acreages).

Chapter 6:

MONITORING AND EVALUATION

This chapter describes how DNR will monitor and evaluate the implementation and effectiveness of this Lynx Habitat Management Plan. For implementation monitoring, three actions are specified. For effectiveness monitoring, two actions are specified. The chapter concludes with a section on how this plan will be evaluated as a result of new information and monitoring activities.

6.1 Monitoring

6.2 Evaluation

6.1 Monitoring

DNR will monitor the implementation and effectiveness of this lynx habitat management plan.

6.1.1 Implementation Monitoring

The purpose of implementation monitoring is to ensure that guidance contained in this plan is faithfully applied to DNR-managed lands within the lynx's range. Implementation monitoring will consist of three major components: 1) reporting of forest management activities (i.e., timber harvest, silviculture activities, road construction and management), 2) field checks of a sample of management activities to verify reporting, and 3) updating of landscape-level (LAU) lynx habitat conditions.

6.1.1.1 Forest Management Activities

DNR will provide WDFW with an annual report that describes three main categories of management activities:

6.1.1.1.1 TIMBER SALES

The report will list the number, size, and location of all DNR timber sales within the lynx's range. For each sale, the report will describe the type of timber harvest that took place; describe the effects of timber harvest on forest structure and lynx habitat conditions; summarize applicable guidance contained in this plan which was applied to sale design, associated road construction, and harvesting; describe any departures from guidance contained in this plan that may have been necessitated by local conditions; provide a detailed rationale for any such departures that occurred; and describe reforestation efforts.

6.1.1.1.2 SILVICULTURE ACTIVITIES

The report will provide the same information (as for timber sales) for all DNR silviculture activities within the lynx' range that influence forest structure and lynx habitat conditions.

6.1.1.1.3 ROAD CONSTRUCTION AND MANAGEMENT

The report will list total miles of active and inactive roads on DNR-managed lands, miles of roads newly constructed during the past year, miles of roads reconstructed during the past year, miles of roads moved from active to inactive status during the past year, and miles of roads permanently retired during the past year. For each newly constructed road, the report will describe how guidance contained in this plan was applied to road planning and construction.

This report will be prepared on a fiscal year basis (July 1 to June 30) and will be delivered to WDFW no later than September 30, three months following the close of the reporting year. The first report will be delivered to WDFW no later than September 30, 1997 and will address activities that occur between the date on which this plan is adopted and June 30, 1997.

6.1.1.2 Field Checks

Each year DNR will field check a portion of its management activities within the lynx's range to verify application of guidance contained in this plan and assess post-harvest conditions. The portion of management activities checked will vary from year to year, depending on size of the sales program and resources available for monitoring; however, at least 20% of all timber sales or five timber sales--whichever number is smaller--will be sampled each year. Additionally, field checks will be carried out for all management activities involving a departure from guidance contained in this plan. Field checks will include the collection of data necessary to assess effects on lynx habitat conditions. WDFW will be invited to participate in all field checks, and results of field checks will be included in the annual report furnished to WDFW.

6.1.1.3 Landscape (LAU) Level Habitat Conditions

Each year, DNR will update its assessment of the proportions of major lynx habitat categories (i.e., denning, forage, forested, non-habitat) within the North, Central, and South Loomis LAUs and the Little Pend Oreille Block. These assessments will address the effects of timber harvest and other management activities, fire and other natural causes of habitat loss, and habitat development as a result of both natural processes and silviculture activities. A description of the findings of the assessment and tables enumerating updated habitat proportions will be included in the annual report furnished to WDFW.

6.1.2 Effectiveness Monitoring

The objective of effectiveness monitoring is to determine whether application of the guidance contained in this plan results in anticipated habitat conditions. Effectiveness monitoring will consist of two major components: 1) sampling to verify the suitability of forest stands as forage and denning habitat, and 2) sampling to assess snowshoe hare use of forest stands. Also, sampling will be designed to detect damage to developing forage habitat resulting from cattle grazing. Effectiveness monitoring will begin in FY98. A detailed effectiveness monitoring plan, including statistically valid sampling designs, will be completed and submitted to WDFW for review and approval no later than April 1, 1997. Results of effectiveness monitoring will be included in the annual report furnished to WDFW.

6.1.2.1 Evaluating Forage, Travel and Denning Habitat

Each year, samples of forest stands classified as forage, travel, and denning habitat will be field checked to verify that forest structure required for forage, travel, or denning actually exists. Field checks will consist of repeated measurements of stand structure and relation of key structural variables to forage, travel and denning habitat definitions. Initial emphasis will be placed on verifying the classification upon which the assessment of current conditions contained in this plan is based. Later, emphasis will shift to evaluating the effectiveness of the guidance contained in this plan in promoting the development of new forage, travel, and denning habitat.

Geographically, emphasis will be placed upon the three Loomis LAUs and the Little Pend Oreille Block. Initially, the Little Pend Oreille Block will be emphasized because information on forest conditions is currently poorer for the Little Pend Oreille Block than for the Loomis LAUs. The amount of habitat sampled each year will depend on the sampling design that is developed and available monitoring resources. However, at least 200 acres (81 ha) of forage habitat, 100 acres (40 ha) of travel habitat, and 100 acres (40 ha) of denning habitat will be sampled each year.

6.1.2.2 Evaluating Snowshoe Hare Use

Snowshoe hare use of different forest types and successional stages will be monitored to evaluate hare-habitat relationships. This is necessary because a) forage habitat is currently the limiting factor for lynx in northeastern Washington, and b) the working definition of forage habitat strongly influences forest management activities on DNR-managed lands pursuant to guidance contained in this plan. Particular emphasis will be placed on evaluating hare response to timber harvesting and silviculture activities. Monitoring will entail correlation of hare use data derived from pellet count transects with data on vegetation, snow depth, and other key habitat variables.

The amount of habitat sampled each year will depend on the sampling design that is developed and available monitoring resources. However, at least 6,565 feet (2,000 m) of transects will be sampled each year.

6.1.3 Cooperative Research

DNR will not undertake complex data collection such as radio-telemetry studies of hare and lynx habitat use or studies of hare and lynx population dynamics as part of this plan. Such studies represent basic research into the ecology of lynx in Washington, and DNR believes such research is primarily the responsibility of WDFW, the Washington Cooperative Fish and Wildlife Research Unit, and the universities. Additionally, such studies are very expensive and are best undertaken as joint ventures supported by several cooperators. Cooperation allows each cooperating organization's resources to be used most efficiently, reduces overall costs, and ensures that all interested parties base their management programs upon the same data. DNR is committed to participating in such cooperative research and will provide financial support for such efforts to the extent that it is able to do so amidst other budget priorities.

6.2 Evaluation

This Lynx Habitat Management Plan will be evaluated every five years by DNR and WDFW. The purpose of these evaluations is to reflect upon five years' of monitoring data and experience in carrying out forest management activities pursuant to guidance contained in this plan, as well as new information on lynx habitat relationships or forest biology that may have arisen. Any changes to this plan that may be prompted by these evaluations will be made by mutual agreement of DNR and WDFW.

In addition, a first-year review meeting will take place in early winter of 1997, after the completion of the first field season of monitoring. The purpose of this meeting will be to review and discuss the results of monitoring to: 1) evaluate post-harvest conditions in Travel Habitat, b) verify Forage Habitat development estimates, and c) verify the suitability of areas classified as Denning Habitat.